

3.008 Mobile Field Measurements of Methane Gas Using Open-Path Cavity-Ring-Down spectroscopy.

Early Career Scientist

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Abstract:

Methane is a significant atmospheric pollutant and greenhouse gas, approximately ~37x stronger than carbon dioxide, and it is becoming increasingly important to quantify emissions from leaks during extraction, production, processing, transportation and storage of natural gas. Recent work has demonstrated that cavity ring-down spectroscopy (CRDS) can be applied in open-path configurations while still achieving relatively high optical sensitivity allowing for detection of ppb level methane increases. Influence due to ambient aerosols is reduced through the use of software filters which remove fluctuations due to particles while preserving the signal as a result of gasses. Spectral peaks are significantly broadened in atmospheric pressure but can be fit using a synthetic spectrum consisting of a sum of relevant Lorentzian peaks, including interfering species. The high-reflectivity cavity mirrors are kept clean using a simple purge mechanism consisting of a micro-diaphragm pump and hepa filter which pull ambient air into a positive pressure enclosure at the mirror surface. We present work showing controlled release and preliminary field measurements using a compact open-path CRDS instrument operating at 1651 nm. Open-path CRDS decreases the weight and power requirements of the sensor so that it can be powered using a simple battery and mounted on mobile platforms such as an automobile or unmanned aerial vehicle (UAV). Our sensor is deployed on the roof of a small truck with a cable connecting the sensor package to a module containing all electronics, controls and power conditioning. Results of field measurements are discussed, including the influence of ambient aerosols, wind and proximity to leaks.